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CHINA'S DIGITAL ECONOMY
A LEADING GLOBAL FORCE

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CHINA'S DIGITAL ECONOMY: A LEADING GLOBAL FORCE

China is already more digitized than many observers appreciate. China is one of the world's largest investors and adopters of digital technologies, and is home to one-third of the world's unicorns.[1] China has the scale to drive rapid commercialization of digital business models, and has the advantage of a very large home market of consumers who are young and eager to embrace digital in all its forms. Three aggressive, giant internet companies with global reach—Baidu, Alibaba, and Tencent, or BAT as they are collectively known—are creating a multifaceted and multi-industry digital ecosystem that touches every aspect of consumers' lives. The government is actively encouraging digital innovation and entrepreneurship by giving companies room to experiment and offering support as an investor, developer, and consumer of new technologies.[2] China's digital transformation is already having a profound impact on its own economy, and is likely to have an increasing influence on the worldwide digital landscape. China's digital globalization is only just getting started and is gathering momentum. Through mergers and acquisitions (M&A), investment, the export of new business models, and technology partnerships, China could set the world's digital frontier in the coming decades.

CHINA IS HOME TO DYNAMIC DIGITAL INNOVATORS, AND IS A LEADING GLOBAL INVESTOR IN THE LATEST TECHNOLOGIES

Conventional measures of China's development and adoption of digital technologies suggest that, so far, it is only in the middle of the global pack. China ranked 50th out of 131 countries on the 2016 Digital Adoption Index published by the World Bank, and 59th out of 139 on the World Economic Forum's Networked Readiness Index.[3] These rankings tend to use national averages, and therefore do not fully capture powerful industry dynamics and consumer behaviors that are rapidly propelling China to becoming one of the world's leading digital players. Our view is that these rankings indicate the vast potential that remains, rather than any structural deficit, and that the opportunity for China in digital is far larger than many observers suggest.

China is already a global leader in e-commerce and digital payments, and is home to one-third of the world's unicorns

Over the past decade, China has become a leading global force in several areas of the digital economy. In e-commerce, for instance, China accounted for less than 1 percent value of worldwide transactions only about a decade ago, but that share is now more than 40 percent. The value of China's e-commerce transactions is today estimated to be larger than the value of those of France, Germany, Japan, the United Kingdom, and the United States combined. Some early investors in leading Chinese e-commerce players are estimated to have earned returns of thousands of times their initial investment. In mobile payments, penetration among China's internet users has grown rapidly from just 25 percent in 2013 to 68 percent in 2016. The value of China's mobile payments related to consumption by individuals was $790 billion in 2016, 11 times that of the United States. Small increases in

1 Unicorns are defined as privately-held startups valued at over $1 billion.

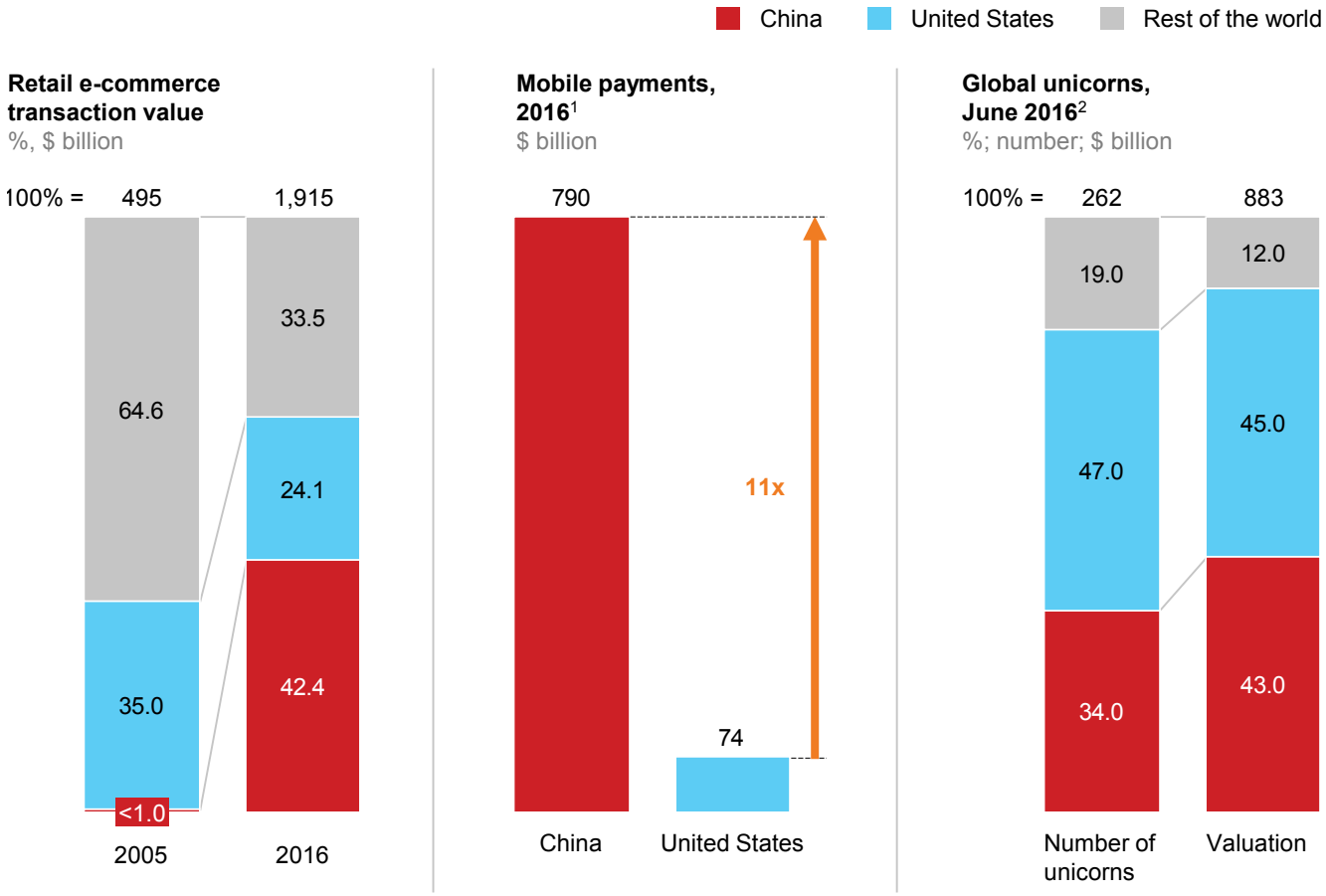
2 MGI research in 2015 found that China has been rapidly improving its performance on innovation in customer-focused and efficiency-driven industries, but that it still has gaps to close in science- and engineering-based innovation, which is arguably more challenging. However, even in these latter types of innovation, China is improving its performance and experimenting with novel approaches. See *The China effect on global innovation*, McKinsey Global Institute, October 2015.

3 The Digital Adoption Index is based on general digital business adoption, internet and mobile access for citizens, and online public services. The Networked Readiness Index is based on the macroeconomic environment, digital readiness and infrastructure, digital usage, and the economic and social impact of the network.

penetration make a large difference given the sheer scale of the market. In digital payments, a 1 percentage point conversion into mobile of bank-card transactions (again related to consumption by individuals) can boost their value by more than $80 billion. Investors are enthusiastic and tend to have high expectations about the growth potential of China's startups. In the fintech category, nine of the 23 privately held unicorns in the world are based in China, and they account for more than 70 percent of the total valuation of fintechs worldwide. One in three of the world's 262 unicorns is Chinese, commanding 43 percent of the global value of these companies (Exhibit 1). As an illustration of excitement among investors about the future potential of some of China's digital players, consider that the combined valuation of two Chinese bicycle-sharing companies of around $6 billion is higher than that of the top two airline companies in South Korea, at about $5 billion.

Exhibit 1

China's digital economy is a story of commercial success and excitement among investors



1 Refers to third-party payments conducted through mobile transactions. For China, mobile payments exclude bank or UnionPay credit card transactions, digital wealth management, and digital finance. For the United States, payments are in-person payments on mobile between buyers and sellers, and remote payments on mobile devices.
2 Defined as a startup valued at $1 billion or above.
NOTE: Numbers may not sum due to rounding.

SOURCE: PitchBook; Dealogic; eMarketer; iResearch; TechCrunch CrunchBase Unicorn Leaderboard; McKinsey Global Institute analysis

China's is one of the leading global investors in digital technologies

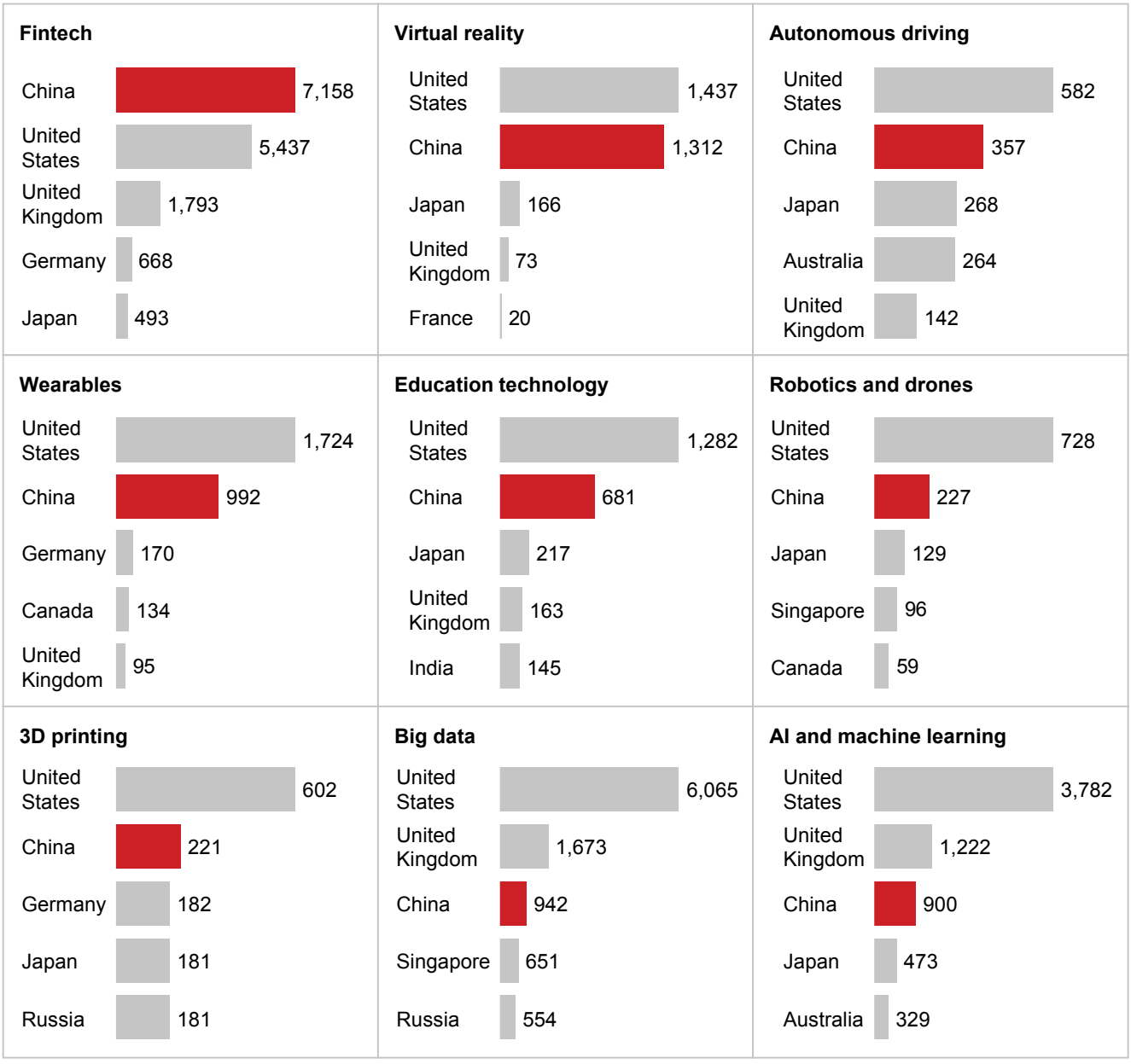
China has one of the most active digital investment and startup ecosystems in the world. Its growing venture capital industry is increasingly focused on digital. Overall, China's venture capital sector has been growing rapidly, from just $12 billion in 2011–13, or 6 percent of the global total, to $77 billion in 2014–16, or 19 percent of the worldwide total. The majority of venture capital investment is in digital technologies such as big data, artificial intelligence (AI), and financial technology (fintech) companies. China is in the top three in the world

for venture capital investment in key types of digital technology, including virtual reality, autonomous vehicles, 3D printing, robotics, drones, and AI (Exhibit 2).[4]

Exhibit 2

China is in the global top three for venture capital investment in key technologies

Venture capital investment in leading technologies, 2016[1]
$ million



1 Based on the nationality of the venture-capital investor. Coinvested deals are counted under each nationality. Investments in startups with multiple technologies are counted in each category of technology.
NOTE: Not to scale.

SOURCE: PitchBook; McKinsey Global Institute analysis

[4] AI-led automation can give the Chinese economy a boost to productivity that could add 0.8 percentage point to 1.4 percentage points to annual GDP growth, depending on the speed of adoption, MGI research finds. See *Artificial intelligence: Implications for China*, McKinsey Global Institute discussion paper, April 2017.

THREE (OFTEN UNAPPRECIATED) FACTORS SUGGEST THAT THERE IS HUGE UPSIDE FOR DIGITAL IN CHINA

China's digital potential is enormous—and far larger than many observers appreciate. We are optimistic for three reasons. First, China's large home market offers powerful scale advantages, and extremely enthusiastic digital natives (aged 25 or under), which will both continue to enable rapid commercialization of digital technologies. Second, competition is fierce in a rich ecosystem that was initially built around the BAT companies but that is now spreading and deepening. Third, government regulators initially left space for innovators to flourish, and they now provide support for China's burgeoning digital sector by facilitating investment in, and adoption of, the latest technologies.

Factor 1: The big and young Chinese market is enabling rapid commercialization of digital business models on a large scale

The sheer scale of China's internet user base encourages continuous experimentation and enables digital players to achieve economies of scale quickly. However, the strength of China's digital consumers goes beyond the advantages of scale—it also reflects the fact that the country's consumers are embracing digital technologies with a passion. Their enthusiasm supports growth in the market now and will do so into the future, facilitates rapid adoption of innovation, and makes Chinese digital players and their business models competitive.

In 2016, China had 731 million internet users. That's more than the European Union (EU) and the United States combined. China also has 695 million mobile users (95 percent of total internet users), compared with 343 million in the EU (79 percent), and 262 million in the United States (91 percent). Digital native internet users number about 280 million, nearly the same as the total number of US internet users. China's large user base of mobile and young people enables faster adoption of digital (Exhibit 3).

Chinese internet users are digitally savvy and tend to use mobile as an integral part of their daily lives. Nearly one in five internet users in China relies on mobile only, compared with just 5 percent in the United States. The mobile share of e-commerce sales stands at around 70 percent in China, compared with around 30 percent in the United States; the share of internet users in China making mobile digital payments is around 68 percent, compared with only around 15 percent in the United States. Chinese users spend ten hours longer each month on social apps than their US counterparts. According to the 2017 McKinsey Chinese iConsumer Survey, an estimated 31 percent of WeChat users have shopped on the platform in 2017, compared with just 13 percent in 2015.[5] The same survey indicates that 83 percent of Chinese internet users used online to offline (O2O) services—which drive online customers to offline businesses—compared with 41 percent in 2015.

Cities also contribute to China's scale advantages. There are 22 cities with populations of more than five million, compared with just one in the United States and four in the EU. The large scale and dense populations of China's cities attract investors and entrepreneurs, and enable a great deal of digital experimentation. In 2016, $20.9 billion of venture capital investment poured into Beijing, compared with $3.4 billion that went to London, and $3.0 billion that went to Los Angeles, and $1.0 billion to Berlin, according to PitchBook. Many of China's regions are as digitized as those of other major economies, if not more. For instance, in Beijing and Shanghai, over 90 percent of households had access to the internet in 2016, around the same as in New York and somewhat higher than San Francisco at 88 percent.[6] The amount of rides in Beijing through taxi-hailing apps is estimated to be about eight times the number in New York. Chinese cities are hotbeds of digital innovation,

[5] For more detail, see *Redefining customer experiences for China's new retail era*, McKinsey & Company, June 23, 2017.

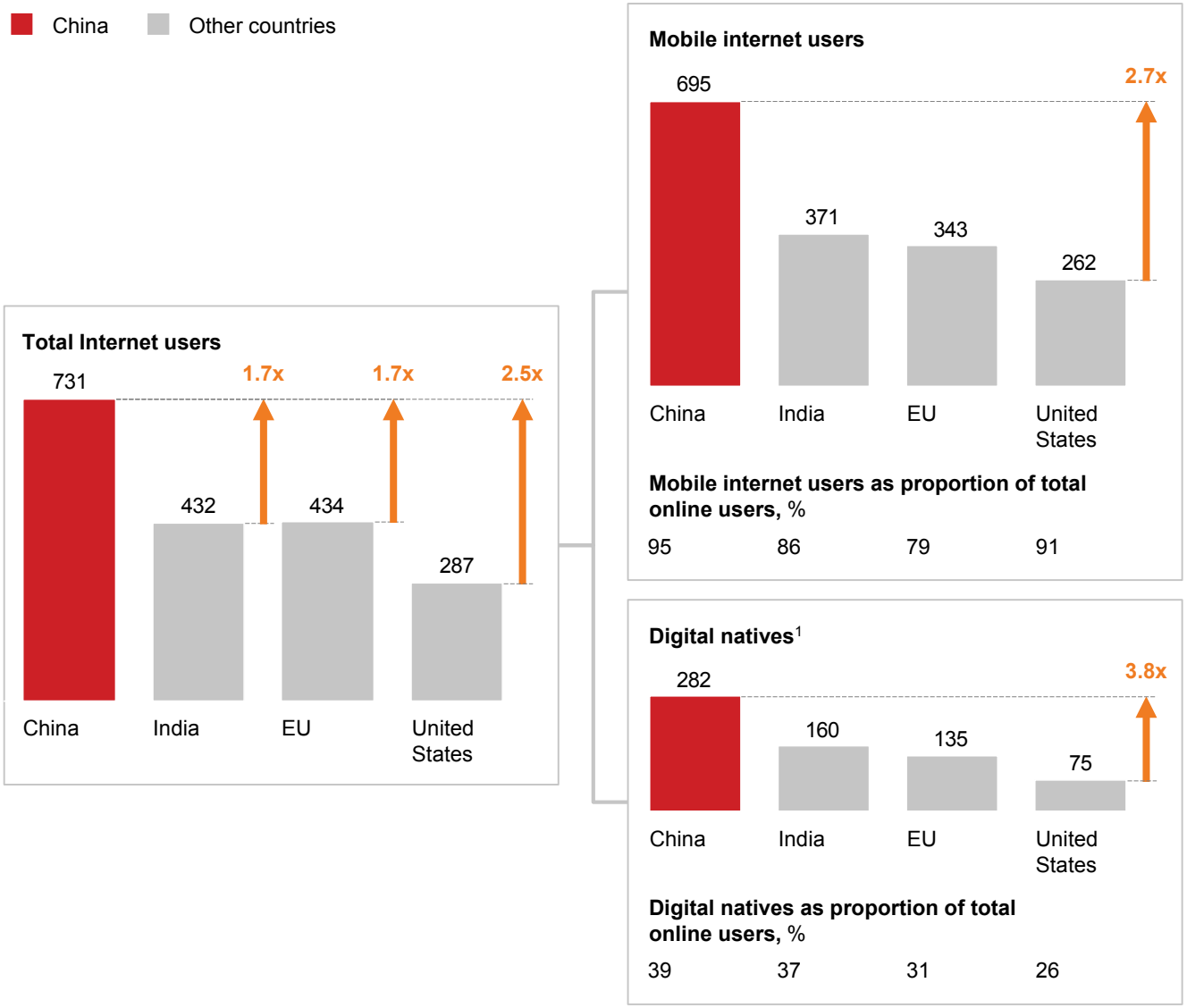
[6] Passbook.

and the scale of urban China fuels O2O consumption. In Shanghai, Ele.me, one of the largest online food-ordering platforms in China, is reported to have delivered an estimated 200 million orders in 2016—equivalent to about 10 percent of total digital orders, including delivery and in-store pickups, in the United States.[7]

Exhibit 3

China enjoys scale advantages, with a large base of 695 million mobile users and 282 million digital natives

Million, 2016



1 Defined as internet users aged 25 or under.

SOURCE: China Internet Network Information Center; Internet & Mobile Association of India; World Bank; Statista; Internet Live Stats; McKinsey Global Institute analysis

Scale enables the development of unique solutions

The scale of mobile and digital use in China does pose unique challenges to the country's digital players. For instance, the combined effect of heavy promotion by e-commerce companies on specific dates and the huge number of internet shoppers in China means that there is much greater volatility in demand—an around 11 times variation in e-commerce

[7] See *Analyzing Ele.me in tier 1 and tier 2 cities*, Sohu, January 24, 2017 (http://www.sohu.com/a/125051753_515896); and *Delivery is bright spot for U.S. foodservice industry*, NPD, April 25, 2017.

transactions between peak and off-peak demand, compared with three times in the United States. It is therefore vital to develop solutions to manage dramatic surges in demand. One example of a demand spike is China's annual Singles Day on November 11, which has become a huge online shopping day. In 2016, Alibaba racked up $17.8 billion in sales, up from $14.3 billion in 2015. Online sales in just one day were more than Brazil's total projected e-commerce sales for all of 2016.[8] Variability in sales leads to fluctuations in the delivery of products to end-users. Comparing the orders of top e-commerce players in China and the United States, the volume of packages delivered at peak times is around 12 times non-peak volume in China, compared with nine times in the United States (Exhibit 4).

Challenges such as huge variations in peak and off-peak volumes of e-commerce transactions have catalyzed the development of new solutions. During Singles Day 2016, Alibaba's payment platform processed 120,000 transactions per second, an estimated three times higher capacity than that of one leading global payments platform.[9] Chinese cloud providers also hold the world record for computing efficiency. In Sort Benchmark's annual global competition—regarded as the "computing Olympics"—Chinese players have rapidly improved their performance in recent years. In the 2013 competition to sort one trillion unordered 100-byte records in ascending order in the fastest possible time, Yahoo set the record with 1.4 terabytes per minute. Since then, three successive Chinese players have broken that record: Baidu with 8.4 terabytes per minute in 2014, Alibaba with 18.2 in 2015, and Tencent with 60.7 in 2016.[10] In a 2016 Sort Benchmark competition on cost efficiency, Alibaba's cloud set the record for the lowest cost for sorting 100 terabytes of data at $144. In 2015 and 2014, the record holders were US companies at $155 and $451, respectively. Massive computing capacity and cost competitiveness can create a strong platform for future innovation, especially as AI, with its ability to process data quickly and increase the speed to learning, becomes more mainstream.

Factor 2: Well-capitalized BAT players are building a rich digital ecosystem that is now growing beyond them

Customers' problems are opportunities for innovators. The scale and intensity of customer usage make China a proving ground for cutting-edge capabilities. Baidu, Alibaba, and Tencent have been building dominant positions in the digital world by taking out inefficient, fragmented, and low-quality offline markets, while driving technical performance to set new world-class standards. In the process, they have developed powerful new capabilities, and a rich digital ecosystem initially centered on the threesome is now spreading. Unicorns and entrepreneurial startups are proliferating. Traditional companies are expanding their platforms, and China's strength in manufacturing enables unique and rapid combinations of physical and virtual innovation.

Inefficiencies in traditional sectors have created opportunities for BAT and others to innovate

China's labor productivity in many sectors is only 15 to 30 percent of the OECD average.[11] There is no shortage of inefficiencies in China's traditional sectors, which tend to be fragmented and offer low-quality services. But this opens up opportunities for digital attackers to innovate, creating new entrance points to the market and providing fresh value for customers. One area in which new players are active is voice-recognition technology (see Box 1, "Why voice-recognition solutions are becoming popular in China").

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8 Frank Lavin, "Singles' day sales scorecard: A day in China now bigger than a year in Brazil," *Forbes*, November 15, 2016.

9 Steven Millward, "China's Alipay just saw a record 1 billion transactions in a day," Tech in Asia, November 14, 2016.

10 Sort Benchmark.

11 *China's choice: Capturing the $5 trillion productivity opportunity*, McKinsey Global Institute, June 2016.

Exhibit 4

Facing huge technical challenges in scale and volatility compared with the United States, Chinese companies have developed greater processing capacities

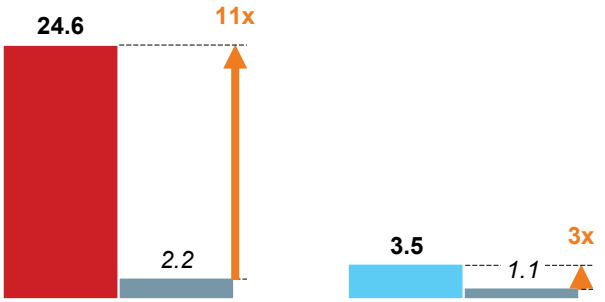
EXAMPLES

Huge variations in peak and off-peak

E-commerce

Online peak sales per day, 2016

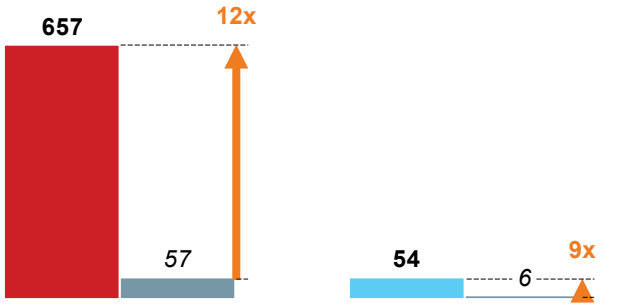
$ billion



Logistics

Peak packages delivered per day by leading e-commerce players, 2016

Million

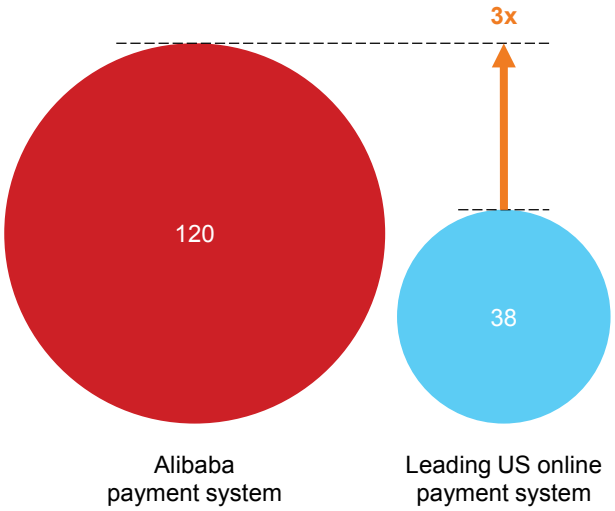


Development of technical solutions

Payments

Processing capacity of payment solutions, 2016

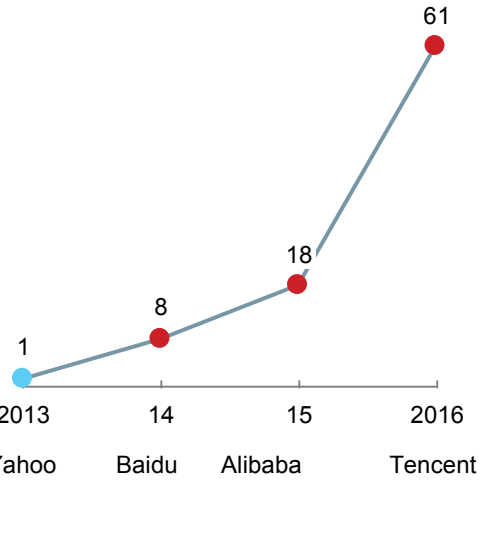
Thousand transactions per second



Computing power

Evolution of world record in computing power[1]

Terabytes processed in one minute



1 According to an assessment of how much data can be processed in a minute in terms of general sorting.

SOURCE: Company official announcements; Profit Confidential; 360doc; Alizala; Sankei; Sort Benchmark; McKinsey Global Institute analysis

Box 1. Why voice-recognition solutions are becoming popular in China

Voice-recognition technologies are gaining popularity due to inefficiencies in typing the Chinese language on mobile phones. The typing speed on a smartphone is 1.1 seconds for each word in English but 1.6 seconds for pinyin, the most widely used system of writing Mandarin with the Latin alphabet—a gap of 40 percent. The error rate is 3.7 percent for English but 20.5 percent for Mandarin.[1] This means that consumers have more incentive to use voice-recognition services when they are reading and writing Mandarin on a mobile phone. Voice recognition more than triples the number of words per minute a user can type into a smartphone, and raises accuracy by 16 percent. Chinese digital companies have seized this opportunity to offer competitive services. For example, iFlytek, a Shenzhen-based technology company, launched a popular speech-recognition app for mobile users and has worked with several hardware companies to embed tools such as secure payment, access control, and hands-free voice control into the app.

1 Khari Johnson, "Stop typing on your phone. Using your voice is faster," VentureBeat, September 5, 2016; and Sherry Ruan et al., *Speech is 3x faster than typing for English and Mandarin text entry on mobile devices*, Stanford University, August 2016.

In the retail sector, for instance, MGI research in 2013 found that the early impact of e-commerce was more pronounced in China's underdeveloped small and midsize cities even though consumers in these areas had lower incomes than their counterparts in large cities.[12] This reflected the fact that, outside China's major urban conurbations, consumers were not well served by offline traditional retailers; online players made products and brands available to them for the first time.

In the financial sector, in the past depositors had to accept low, and sometimes negative in real terms, interest rates at a time when those rates were regulated. In response to this situation, Alibaba launched Yu'e Bao, which offers interest rates that are two to four percentage points higher. Consumers jumped in, and it took only nine months for Yu'e Bao to become the fourth-largest money market fund in the world. Today, it manages $165 billion and is the world's largest money market fund.[13] Another example is Alibaba's Sesame Credit service, which addresses the fact that only about one-quarter of the Chinese population has a credit score, compared with nearly 90 percent in the United States. This digital-credit-rating service takes advantage of the huge amount of consumer data that now exist online. Alibaba calculates a "social-credit" score based on personal information, ability to pay, credit history, social networks, and behavior. The service covers 381 cities and eight industries. It offers a feature for people with high social-credit scores that covers deposits for hotel bookings and rental of cars and devices; one million deposits have already been waived. A high social-credit score is regarded by many Chinese as a personal "selling point"—15 percent of users of the online dating site Baihe display their scores on their profiles.

In transportation, commuting in large cities is painful. Only 48 percent of passengers in Shanghai can get a taxi during peak hours, according to one survey.[14] Beijing's traffic jams lead to an estimated $11 billion in lost productivity per year, one study found.[15] Sometimes

12 *China's e-tail revolution: Online shopping as a catalyst for growth*, McKinsey Global Institute, March 2013.

13 Louise Lucas, "Chinese money market fund becomes world's biggest," *Financial Times*, April 26, 2017.

14 Liqin Yin, "Shanghai is in the top three most difficult cities for taxi hailing in China," Sina Shanghai, January 21, 2016 (http://sh.sina.com.cn/news/m/2016-01-21/detail-ifxnuvxh5048360.shtml).

15 Men Jing, "Traffic jams cost average Beijinger $1,126 annually," *China Daily*, January 20, 2016.

passengers are forced to take unlicensed private cabs, which have a reputation for not being as safe as licensed vehicles. These challenges for consumers contributed to the rapid rise of the ride-sharing sector and the bicycle-sharing business model. All three BAT internet giants now have a stake in Didi Chuxing, China's largest ride-sharing company, which was formed after the merger of competitors Didi Dache and Kuaidi Dache, which had been backed by Tencent and Alibaba, respectively.

In health care, Baidu is hoping to use its AI solution Baidu Medical Brain to help address some of the challenges facing the Chinese health-care system, which suffers from structural inefficiencies including a huge urban-rural imbalance of resources, inconsistent quality of treatment, a shortage of doctors and nurses, and lengthy wait times. In addition, in 2016, Baidu launched Melody, an AI-based chatbot designed to help patients and doctors by providing relevant information, including recommendations and treatment options.

The BAT companies are developing a multifaceted, multi-industry digital ecosystem

The BAT companies and others like them began their ascent with an anchor offering—e-commerce in the case of Alibaba, internet search for Baidu, and social media for Tencent—but have expanded into products and services spanning multiple industries.

Alibaba's core e-commerce business through its online shopping website Taobao was founded in 2003. Alibaba later added the Alipay digital payments business; digital wealth management through companies such as Yu'e Bao; and entertainment through, for instance, the acquisition in 2016 of Youku Tudou, a major video streaming and internet television player.

Baidu started with its search engine, which today accounts for over 80 percent of market share in China. The company then gradually moved into mobile services on the back of its more than 660 million monthly users of mobile search. In recent years, Baidu has invested billions of dollars into O2O services including food delivery, group buying, and financial products. Now the company is shifting its strategic focus to AI and its commercial application in various sectors. Baidu is opening up its autonomous-vehicle technology to others in an attempt to develop a broader ecosystem. In April 2017 at the Shanghai Auto Show, Baidu unveiled its Apollo project, which it described as an "open, complete and reliable software platform" for its partners in the automotive and autonomous driving industry. [16] Observers see Baidu's move as part of China's broader ambition to become the leading hub for AI.[17] The Apollo project is designed to help partners accelerate bringing autonomous-driving products to market by supplying them with data, APIs, some open-source code, and even reference hardware. Baidu's aim is for the platform to be able to handle full autonomous driving in urban areas by the end of 2020.[18]

Tencent's main business is social media including services like WeChat, a messaging app first released in 2011 that had more than 900 million active users by 2017. Social-media services have been a powerful springboard for expansion into other areas such as payments (Tenpay), online banking (WeBank), and on-demand dining services (Meituan-Dianping).

The "super apps" offered by both WeChat and Alipay are the natural evolution of this diversification, offering consumers a one-stop shop covering education (such as tuition payments), health (such as physical activity tracking and medical appointments), information

[16] Charles Clover and Sherry Fei Ju, "Baidu to open-source its autonomous driving technology," *Financial Times*, April 19, 2017.

[17] Will Knight, "The self-driving project that could help China leapfrog the West," *MIT Technology Review*, July 5, 2017.

[18] Darrell Etherington, "Baidu's Apollo platform becomes the 'Android of the autonomous driving industry,'" TechCrunch, July 5, 2017.

services (news and search), entertainment (gaming and video), e-commerce, and social interactions (Exhibit 5). WeChat's super app has expanded to 40 functions, with more lifestyle and finance-related services than previously, while Alipay's has 90 functions, about seven times more than the company offered in 2011.

The rise of the super app gives China's internet giants advantages in the speed of collection of consumer data and its diversity. As the companies have expanded their ecosystems and built up huge user bases, they have been able to accelerate the commercialization and performance of new products and services significantly. For example, it took eight years for Alibaba's Taobao to gain 100 million users, but only five for Alipay to reach the same milestone, and only six months in the case of live broadcasting. Similarly, it took 12 years for Tencent's instant messaging software QQ to gain 100 million users, but only 18 months for WeChat and less than a year for Tenpay. Hongbao—which means "red packets," a nod to the envelopes in which Chinese put cash gifts for friends and relatives during the lunar new year—needed only days to win millions of users for its gift service.[19]

These giant internet companies now touch almost every aspect of consumers' lives, and they are in a position to tap into a comprehensive understanding of consumers—a 360-degree view. They can monetize data by offering their customers analytics services. For example, Tencent provides analytics solutions to its corporate customers. When the movie *Kong: Skull Island* was released in China in March 2017, Tencent used its huge data mine to send out 46 million advertisements targeted at potential filmgoers. Users were able to download Kong emojis as part of the co-branding and marketing of the movie. Twelve of Tencent's most popular mobile games ran marketing campaigns with ticket giveaways. *Kong: Skull Island* earned $169 million in China, the biggest share of its worldwide box-office take of $565 million, larger than receipts in Canada and the United States combined.[20]

China's digital ecosystem is growing beyond the big three

China's digital ecosystem today is spreading beyond the big three, although BAT has, without a doubt, been a powerful enabler. In 2016, Baidu, Alibaba, and Tencent provided 42 percent of all venture capital investment in China. They played a far more prominent role in the development of the digital sector than Facebook, Amazon, Netflix, and Google (often described collectively as FANG), which together contributed only 5 percent of venture capital investment in the United States in that year. One in five top Chinese startups was founded by BAT or BAT alumni, and an additional 30 percent of them receive funding from the BAT firms (Exhibit 6).

Other digital players are building ecosystems, too. For example, Xiaomi has been diversifying around its core product—the smartphone—to embrace aspects of the consumer lifestyle. It has introduced products including "smart" rice cookers, hover boards, robot vacuum cleaners, digital bathroom scales, and electric air purifiers. The company has invested in many hardware startups and allowed them to use Xiaomi brands.[21] It also developed MIUI, a customized operating system based on Android, to power adjacent products on its platform. Its strategy is to maximize the power of its loyal fan base as well as cross-sector synergies.

[19] "WeChat users send 46 billion digital red packets over Lunar New Year – Xinhua," Reuters, February 4, 2017.

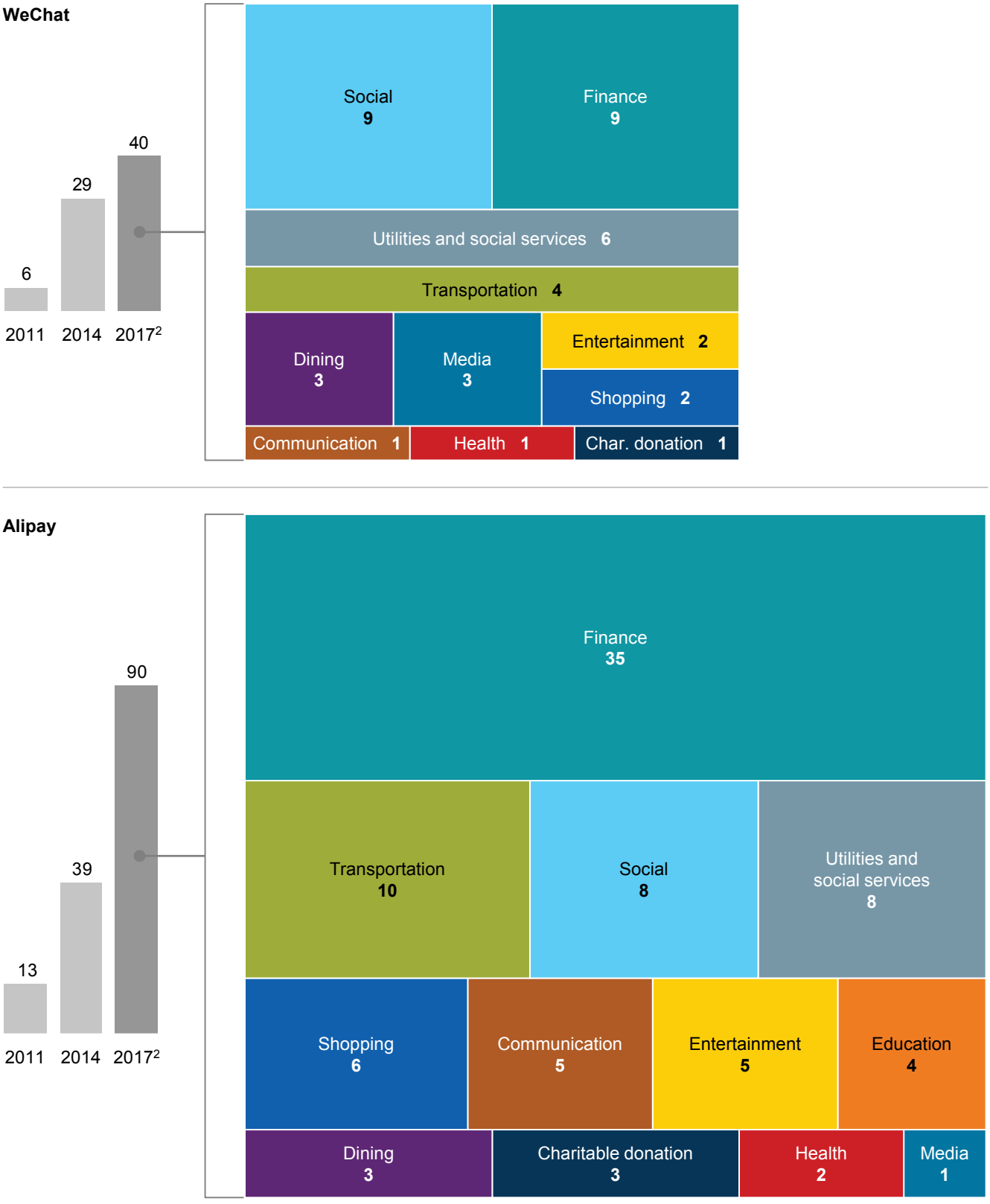
[20] Li Yuan, "China's Tencent has an entertainment reach Hollywood would envy," *Wall Street Journal*, June 1, 2017.

[21] "Xiaomi rebounds on ecosystem," *China Daily*, October 24, 2016.

Exhibit 5

Chinese players have developed super apps that offer a one-stop solution to consumers

Number of features by key application categories[1]



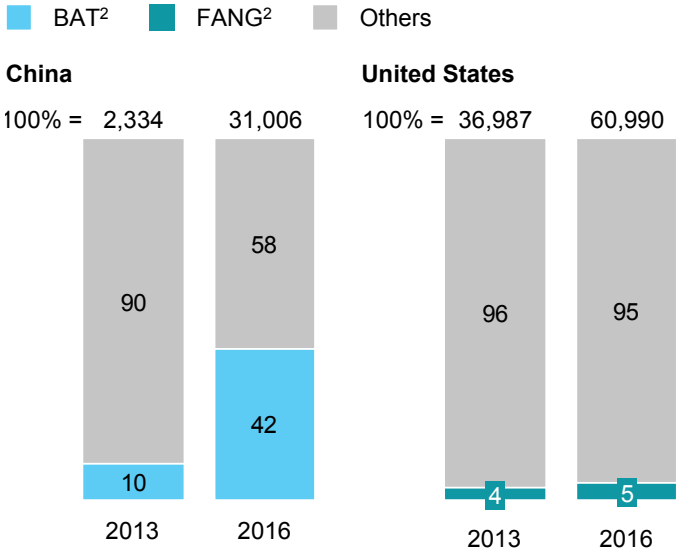
1 Includes newly released app features based on press releases and grouped into 12 key categories: education, entertainment, health, shopping, dining, social, finance, communication, transportation, utilities and social services, media, and charitable donation.
2 As of April 2017.
NOTE: Numbers may not sum due to rounding.

SOURCE: Company announcements; McKinsey Global Institute analysis

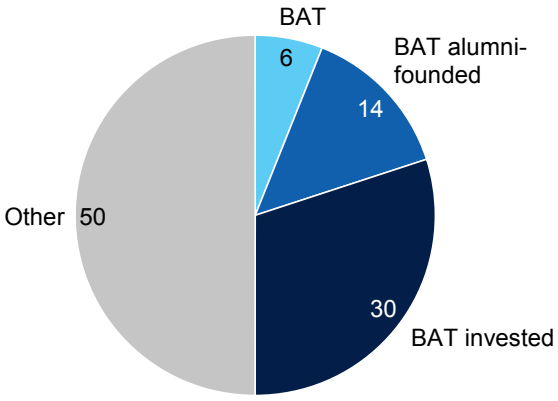
Exhibit 6

China's Internet giants are providing funding and talent to the broader digital economy

Venture capital investment from China vs. United States, 2016[1]
%; $ million



Top 50 startups in China[3]



1 Includes completed domestic venture capital investment deals only.
2 BAT = Baidu, Alibaba, and Tencent. FANG = Facebook, Amazon, Netflix, and Google.
3 According to CrunchBase, which ranks global startups based on number of connections within the platform, community engagement, funding events, news articles, and acquisitions.
NOTE: Numbers may not sum due to rounding.

SOURCE: PitchBook; CrunchBase; McKinsey Global Institute analysis

Beyond BAT, NetEase, a leading Chinese internet technology company, has one of the largest mobile news applications, and is building its own digital ecosystem. Founded in 1997, the company now has more than ten billion page views per month. NetEase also established a digital ecosystem in both the domestic and international markets that embraces online PC and mobile games, online video entertainment services Bobo and CC, advertising services, email services (with voice search and facial recognition), e-commerce platforms including the cross-border offering Kaola, and online payments and finance through Wangyubao. In July 2017, Disney China and NetEase announced that they were teaming up to create a new cohort of Chinese superheroes to join the Marvel Universe. Twelve Marvel comics, including Spider-Man, Captain America, and Guardians of the Galaxy, are officially available on NetEase's comics platform.[22]

Traditional companies are also expanding into connected products and services on the back of their core businesses. For example, PingAn, a leading financial services company, has branched out from life insurance into wealth management, car financing and insurance, housing finance, consumer lending, and medical insurance and services. Ping An operates multiple platforms. It has one of China's largest peer-to-peer (P2P) lending platforms, an online real estate platform for crowdfunding, financing, and renting, and an O2O medical services app with which 50,000 doctors collaborate, for example.[23]

Another notable advantage of China's digital ecosystem is its close links to hardware manufacturers. Rapid adoption of digital in China was possible because of low-cost

[22] Fergus Ryan, "Marvel and NetEase to create new Chinese superheroes for Marvel Universe," China Film Insider, July 7, 2017.
[23] He Huifeng, "Medical services app Ping An Good Doctor raises US$500m," *South China Morning Post*, May 20, 2016.

products offered by domestic manufacturers. For example, the penetration of cheap (but superior in some features to more expensive models) smartphones enabled the rapid spread of the mobile internet. Chinese-brand mobiles accounted for less than 5 percent of the total domestic market in 2007; that share has risen to about 90 percent.[24] China is also a leading producer of internet of things devices. For instance, China manufactured an estimated 70 to 80 percent of global wearable smartwatches in 2016. China, in particular the Pearl River Delta industrial center, is likely to continue to be a major producer of connected devices because of its strength in manufacturing hardware (see Box 2, "The rise of China's Silicon Delta").

Factor 3: The government gave digital players space to experiment before enacting official regulation, and is now becoming an active supporter

The Chinese government has mixed inaction and action in its approach to digitization. It moved to regulate the burgeoning digital sector only after a delay, an approach that gave innovators plenty of space to experiment. But today, the government is playing an active role in building world-class infrastructure to support digitization as an investor, developer, and consumer.

[24] "Over 500 million volume of shipping for Chinese mobile phones, accounting for 90% in 2016," China Institute of Telecommunications, January 11, 2017 (http://www.199it.com/archives/556239.html).

Box 2. The rise of China's Silicon Delta

Shenzhen used to be known as the world center for *shanzhai* or copycat products—for example, devices that looked identical to iPhones or Samsung Galaxy S, available before the official products even came to market. But times have changed. Shenzhen is now known as China's open innovation center, and digitally connected networks have been the key enabler. Here we highlight just three examples of how innovators in the city are using digital.

DJI. The Shenzhen-based drone manufacturer commands more than 70 percent of the global consumer drone market; more than 80 percent of revenue comes from outside China. About half of the company's 3,000 workers are engaged in research and development. CEO Frank Wang spends a significant portion of his time with the R&D team. Digital communication plays an important role in exchanging ideas and cutting through organizational hierarchies. The working teams can use WeChat to debate ideas and get rapid feedback from the CEO, helping to accelerate the speed of innovation.

HAX. The hardware-focused incubator brings entrepreneurs from around the world to the city for rapid prototyping and commercialization. Like many electronics suppliers, HAX is based in the Huaqiangbei district of one of the largest electronics markets in the world. To help entrepreneurs from abroad easily connect with local experts, suppliers, and partners and tap into Shenzhen's digital ecosystem, the company encourages them to use WeChat.[1]

Shenzhen Capital Group (SCGC). Founded by the Shenzhen municipal government in 1999, SCGC is now China's leading domestic venture capital firm, managing more than 200 billion renminbi ($29 billion). In 2016, the company reported a net profit of 1.3 billion renminbi ($191 million), representing an annual return on investment of 36 percent.[2] In the 600-plus enterprises SCGC helps to finance, investment in internet companies has become an increasing focus.[3] SCGC's digital investments cover a wide range of sectors, from consumer goods to infrastructure, and include manufacturers of virtual reality entertainment equipment, robotics startups, and smart city infrastructure providers.

[1] Li Yuan, "Behind the great firewall, the Chinese internet is booming," *Wall Street Journal*, June 8, 2017.

[2] Fangyuan Gao, "Ten pioneer PE market makers show a 'butterfly effect' tendency," Xinhua, December 16, 2016 (http://news.xinhuanet.com/fortune/2016-12/16/c_1120127617.htm); and Cui Yan, "Shenzhen Capital Group's net profit achieved 30% year-on-year growth in 2016," Sina, June 2, 2017 (http://finance.sina.com.cn/roll/2017-06-02/doc-ifyfuvpm7200922.shtml).

[3] Zilin Wang, "Analysys received 90 million in series B financing, SCGC as the lead investor," China Securities Network, October 27, 2016 (http://news.cnstock.com/news,bwkx-201610-3933931.htm).

Inaction: The government gave players a free hand to experiment

Light-touch—or, more accurately, late—regulation of digital activities and players in China has encouraged entrepreneurship and experimentation (Exhibit 7). While the response of regulators lagged behind market developments, China's internet giants were relatively free to test and commercialize products and services and to gain critical mass. For example, regulators took 11 years after Alipay introduced online money transfers in 2005 to set a cap on the value of the transfers. It was five years after Alipay introduced barcode-based payment solutions that Chinese regulators produced an official standard on management requirements.

The rapid penetration of digital devices has partly reflected weak enforcement of intellectual property rights in the early stages of the development of the internet in China. In the first wave of digitization, consumers had relatively easy access to digital content, including music, books, and movies. The fact that consumers were able to access free content helped penetration of digital devices to deepen and broaden. We do note, however, that the light-touch approach to regulation led to copying and patent infringement that has the potential to reduce perceived incentives for real innovation in the economy. In 2008, the International Federation of the Phonographic Industry consortium of leading content companies said that more than 99 percent of music downloads in China were illegal, and the organization sued some search sites.[25] A 2010 survey found that piracy had resulted in a 100 billion renminbi ($15 billion) loss in the software sector, and a 28 percent loss in sales.[26] As the market has matured, both the government and the private sector have gradually become more proactive about shaping healthier digital development through regulation and enforcement. For instance, in 2014, China began opening specialized intellectual property courts in Beijing, Guangzhou, and Shanghai. As leading Chinese companies grow and many are newly listed on domestic and overseas stock markets, they have stepped up efforts to comply with intellectual property rules.

While the regulatory vacuum encouraged exponential growth among digital players, it also sometimes led to supervision and consumer protection issues. For example, the number of P2P lending platforms in China soared to 3,500, but then fell by about one-third from their peak. During the initial hype and subsequent adjustment, consumers suffered some collateral damage. In 2015, Ezubao, one of the largest and best-known P2P lenders, was exposed as a Ponzi scheme in which 900,000 users lost 50 billion yuan ($7.6 billion).[27] According to a recent report, nine out of every ten P2P lenders may struggle to survive as the government tightens regulation.[28] In China's more developed digital environment, the government has unveiled new regulations. The first cybersecurity law, which became effective in June 2017, includes protection of personal information, security requirements for network operators, and restrictions on personal and business data transfer.

[25] Mure Dickie, "Music companies launch new Baidu lawsuit," *Financial Times*, February 5, 2008.

[26] *China lost over 100 billion RMB in software sales because of privacy last year*, China Labs and CyTeam, May 13, 2011 (http://ip.people.com.cn/GB/14624176.html).

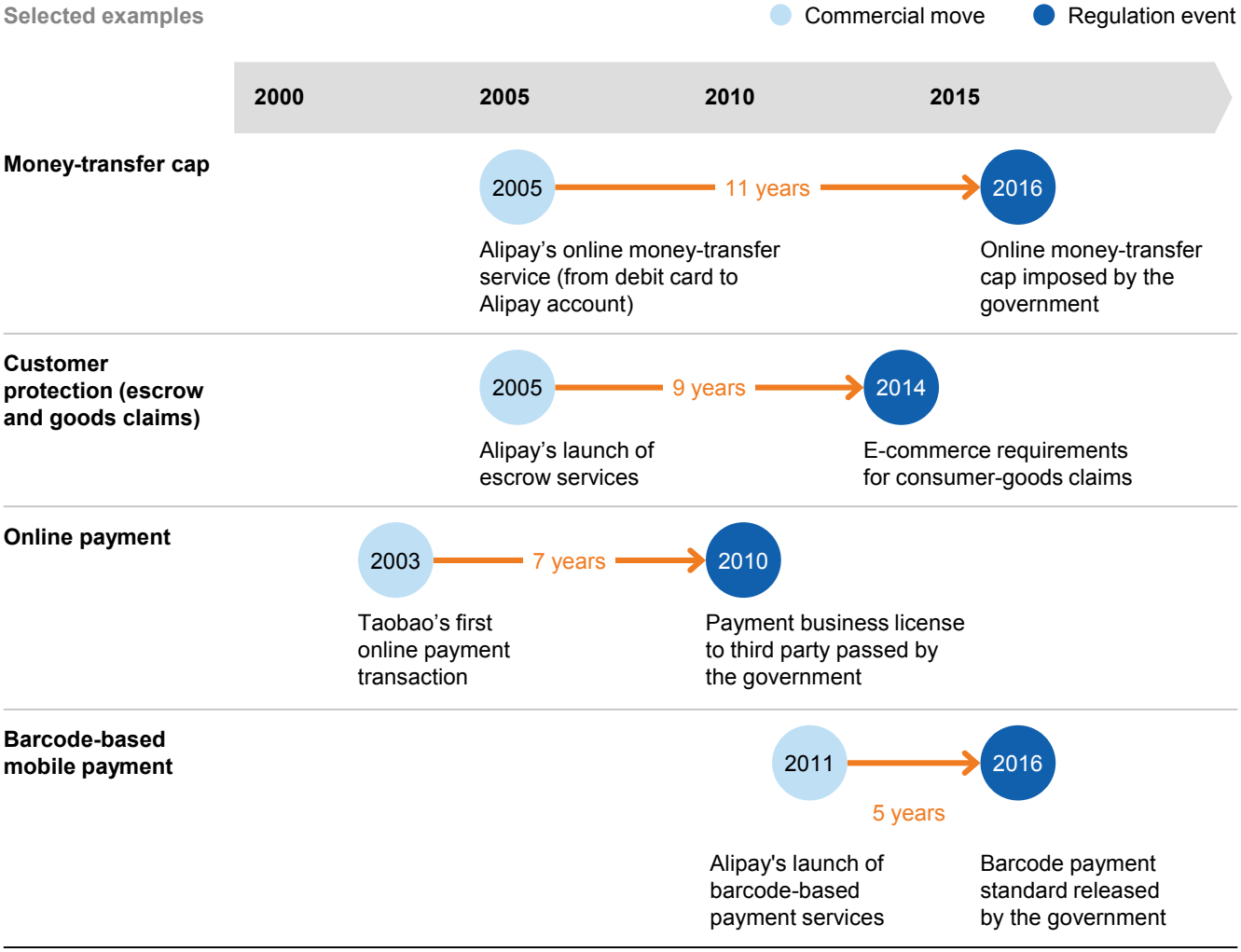
[27] "Ponzis to punters: Financial scams may pose as big a political problem for Xi Jinping as the stockmarket crash," *The Economist*, February 6, 2016.

[28] Daniel Ren, "China regulators warn that 90 pc of peer-to-peer lenders could fail in 2017," *South China Morning Post*, February 19, 2017.

Exhibit 7

In mobile payments, government policy left space for innovators to experiment

Selected examples



Online payment transactions $ billion	<1	2	149	1,811

SOURCE: Official regulatory announcements; SAIC and Ministry of Commerce; Alibaba, Baidu, and Tencent annual reports; McKinsey Global Institute analysis

Action: The government has been not only a policy maker but also an investor, innovator, and consumer in an effort to support digitization

The Chinese government has advanced a number of policies designed to strengthen the digital economy as a new engine for economic growth. In 2015, the government unveiled the concept of "Internet Plus" and followed up with a detailed action plan to integrate the internet, cloud computing, big data, and the internet of things with traditional manufacturing and consumer industries.[29] Over the past two years, the government has led implementation of Internet Plus in a range of sectors including logistics, social security, and manufacturing.

In June 2017, Shanghai launched the first internet shipping port, which integrates e-commerce companies in shipping logistics, data analytics, related financial and legal

[29] "China unveils Internet Plus action plan to fuel growth," The State Council of the People's Republic of China press release, July 4, 2015.

services, and office space in one place.[30] Zhejiang Province is running pilot programs to explore the development of online applications for social security cards that will enable citizens to pay for health insurance via the internet and mobile phones. The idea is to integrate a range of services, including applications for official identification and the filing of government documents, into one portal that has social media applications such as WeChat.[31] Shenzhen has employed Internet Plus in government services since 2014, saving citizens a great deal of time on the filing of property, work, and school-entrance certificates.[32]

The government has also actively facilitated investment in digital. Since 2016, the National Development and Reform Commission of China, the government's economic planning agency, has announced its "Three Year Action Plan of Internet Plus Artificial Intelligence" that aims to build an AI application market valued at more than 100 billion renminbi ($15 billion) by developing nine major AI ecosystems, including smart home appliances, intelligent automotive, wearable devices, and smart terminals. The plan stipulates that various government institutions can provide funding for specific projects from budgets controlled by central and regional governments. In March 2017, the agency authorized Baidu to lead the first national engineering lab focusing on deep learning in collaboration with institutions including Tsinghua University, the China Academy of Information and Communications Technology, and the Beijing Electronics Standardization Institute.

In addition, the government provides funds to new internet businesses. Since 2014, the state has encouraged citizens to participate in mass entrepreneurship and innovation using measures such as tax deductions and state-endorsed startup funds. At least 2,500 tech incubators in China have passed the government's registration requirement.[33] Many municipal governments have set up incubators and offered generous funding. In August 2016, the government approved the establishment of a state-owned $30 billion venture capital fund in Shenzhen, home to many digital startups.[34] Beijing Zhongguancun Inno Way, a high-tech community known as China's Silicon Valley, launched its first 500 million renminbi ($74 million) venture capital fund targeting AI-related startups. Zhongguancun alone has incubated 1,900 startups in the past three years.[35] The government has also shown itself to be willing to pilot the commercialization of new technologies through state-owned enterprises including China Mobile, China Unicom, and China Telecom. The plan is for these companies to spend up to $180 billion over seven years on building the infrastructure for what is envisioned as the world's largest 5G mobile network.[36]

The Chinese government itself has been an ambitious innovator of high-tech R&D. Its successful launch of Micius, the world's first high-security quantum satellite, signaled its ability to lead innovation and experimentation.[37] The satellite is China's first successful

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30 Zhiyan Wang, "China launched its first 'internet plus' shipping industry base in Lujiazui, Shanghai," *Shanghai Observer*, June 23, 2017 (http://sh.eastday.com/m/20170623/u1ai10669236.html).

31 *"Once at most": Zhejiang Province to increase efficiency through "internet plus" social security services in collaboration with the Ministry of Human Resources and Social Security*, Zhejiang Government, June 23, 2017 (http://zjzwfw.gov.cn/art/2017/6/23/art_1177809_7819592.html).

32 Zhangwen Lian, "Shenzhen shares its experiences in 'internet plus' government services," Xinhua, April 29, 2017 (http://news.xinhuanet.com/info/2016-04/29/c_135323019.htm).

33 "Top 50 innovation and startup incubator report: China has the most incubators in the world," Sohu, September 18, 2016 (http://www.sohu.com/a/114536039_379992).

34 C. Custer, "Report: China's government establishes $30 billion VC fund," Tech in Asia, August 17, 2016.

35 Xiaoyu Li, "Innoway launches its first 500 million RMB startup VC, with focus on AI," Xinhua, June 6, 2017 (http://news.xinhuanet.com/fortune/2017-06/06/c_129626451.htm).

36 Bien Perez, "China set to build the planet's largest 5G mobile network for US$180b," *South China Morning Post*, June 12, 2017.

37 Stephen Cheng, "China's hack-proof quantum satellite leap into space leads the world," *South China Morning Post*, August 16, 2016.

venture in quantum technology. If the technology is fully commercialized, China could potentially offer the world's safest and fastest internet.[38]

The government has also acted as a consumer of new digital technologies. China's high-speed rail project is an example of the government's playing a central role in creating a new market, facilitating the transfer of technology, and encouraging innovation.[39] Local leaders are already adopting the latest technologies to improve the management of urban areas. For example, facial-integration technology using AI is being deployed to influence citizens' behavior. In some districts of Shenzhen, for instance, photographic images of jaywalkers are taken and then displayed on video screens installed above streets.[40] Anhui province worked with an AI company to identify phone scammers by analyzing voiceprints created using biometric and behavioral characteristics.[41] Growing markets can help to enable the commercialization of such technologies, although there may be some social discomfort about the use of such solutions by policy makers to scrutinize citizens' behavior.

CHINA'S DIGITAL GLOBALIZATION IS JUST GETTING STARTED—AND IS LIKELY TO HAVE A MAJOR IMPACT ON THE WORLD ECONOMY

In combination, the three factors propelling the expansion of digital China mean that China has an increasingly visible presence on the global stage and rising impact on the global economy. Over recent decades, the Chinese economy has become closely integrated into the global economy through global value chains, but the future is expected to be about digital globalization rather than physical trade.[42] A rising number of Chinese digital companies are developing a global presence through M&A, by expanding their business models, and as providers of technology to partner companies. These developments could mean that China sets the world's digital frontier in coming years. China's increasing prominence on the world's digital stage also means that China can contribute, and even lead, broader debates on global governance issues such as barriers to foreign competition, reciprocity, and digital sovereignty.

China is already a major player in global data flows

China's digital ecosystem is already having a marked influence on global cross-border flows of goods, services, finance, and data. Its exports and imports of digital goods and services have facilitated those flows. Although China has been running a trade deficit in services—of $172 billion in 2014 and $182 billion in 2015—it has been a net exporter of digital services, with an annual surplus of $10 billion to $15 billion over the past five years. Although China is widely criticized for constructing a "Great Firewall" to control the flow of information, it is already in the worldwide top six for flows of data in terms of bandwidth.[43] As recently as 2005, it ranked 13th on data flows.

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38 Qinxiu Chen, "Quantum technology will bring infinite possibilities," *Economic Daily*, February 2, 2017 (http://news.xinhuanet.com/info/2017-02/11/c_136048777.htm); and "China launches quantum-enabled satellite Micius," BBC, August 16, 2016.

39 *The China effect on global innovation*, McKinsey Global Institute, October 2015.

40 Josh Chin and Liza Lin, "China's all-seeing surveillance state is reading its citizens' faces," *Wall Street Journal*, June 26, 2017.

41 "Minitrue: 'Voiceprint analysis can recognize swindlers,'" *China Digital Times*, February 28, 2017.

42 China's share of global manufacturing value added increased from less than 7 percent in 2000 to nearly 28 percent in 2016. Since 2013, China has been the world's largest trading nation for goods, overtaking the United States, which had been the largest since World War II. MGI has conducted extensive research on global flows, including digital flows. See *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016; *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, McKinsey Global Institute, April 2014; and *China's role in the next phase of globalization*, McKinsey Global Institute discussion paper, April 2017.

43 Defined as the sum of all bandwidths (gigabits per second) of a certain country, compared with the rest of the world. The top five countries, in order, are the United States, Germany, the United Kingdom, France, and the Netherlands.

China is becoming a major worldwide investor in digital

China-based venture capital companies are increasingly active overseas investors. China's outbound venture capital totaled $38 billion in 2014–16, reaching 14 percent of global venture capital investment outside China.[44] Between 2011 and 2013, that share accounted for only 4 percent at just $6 billion. About 80 percent of investment went to advanced economies, and approximately 75 percent was invested in digital-related sectors. Clearly, China's influence in the global startup market is growing rapidly as it drives to acquire technology, talent, and products and services.

Chinese digital companies are active in driving global M&A activities

Over the past two years, China's top three internet companies made 35 overseas deals, compared with 20 by the top three US internet companies. Tencent struck a high-profile deal to take a majority stake in Supercell, the developer of the popular Clash of the Titans computer game; the deal valued Supercell at $8.6 billion. Tencent now generates more than 10 percent of global gaming revenue, making it the largest gaming company in the world.[45] In 2016, Alibaba invested $1 billion to acquire a controlling interest in leading e-commerce platform Lazada, which has 550 million customers in six Southeast Asian countries. Traditional companies are also expanding rapidly and developing an international presence in digital technologies. For instance, telecommunications equipment and services company Huawei spent $192 million in December 2016 alone on the acquisition of two Israeli startups focused on the cybersecurity of database technology and on software-based system and chip-design technology.

China is exporting digitally driven business models

Chinese digital companies are also expanding business models outside the country's borders. Ofo and Mobike, China's "dockless" bicycle-sharing companies, have moved into Singapore, the United Kingdom, and the United States. The GPS-connected bicycles can be located and unlocked using an app.[46] Musical.ly, a lip-syncing and video-sharing app, is arguably the first social media app from China that has gained widespread popularity in the United States and other parts of the world. Initially launched in both Chinese and English, Musical.ly shifted focus to the United States and other markets as demand in the United States took off. The app now has more than 100 million users around the world.[47] Meitu, a selfie app with image-editing software that enables users to beautify self-portraits, has become very popular with young customers. The company has expanded aggressively, setting up offices in Brazil, India, Japan, the United Kingdom, and the United States, among others.

China's digital players are enabling digitization globally

China's digital technology is also enabling foreign partners. For instance, in 2017, news aggregation app company Jinri Toutiao ("today's headlines") invested $19 million in one of India's largest local-language content aggregation and recommendation service providers, Dailyhunt. The CEO of Dailyhunt said that the company intended to use Jinri Toutiao's technology and expertise to execute large-scale personalization through machine learning.[48] KT Corporation, South Korea's largest telephone company, cofounded K-Bank, the country's first internet bank, and Alibaba affiliate Ant Financial became a shareholder.

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[44] Calculated as outbound venture capital investment by China-based companies divided by total global venture capital investment by companies based outside China into all countries except for China. All figures are based on the values of deals that have closed.

[45] "Supercell acquisition: Tencent set to take 13% of this year's $99.6bn global games market," Newzoo, June 21, 2016.

[46] Benjamin Haas, "'Uber for bikes': Chinese firms eyes global dominion with launch in Manchester," *The Guardian*, June 12, 2017.

[47] Sherisse Pham, "How a Chinese social media app made it big in U.S.," CNN Tech, November 27, 2016.

[48] Shashti Shankar, "Franklin PE arm exits Dailyhunt, clocking over 3-fold return," *Economic Times* (India), February 1, 2017; and Malavika Yalayanikal, "China's ByteDance leads $25m funding for Indian local language news app Dailyhunt," Tech in Asia, October 15, 2016.

Ant Financial also provides technical solutions such as fraud detection systems—a critical part of running an internet-based bank.[49] Nvidia, a California-based mobile and computer processing company that designs graphics processing units for the gaming and professional markets, as well as chip units for the mobile computing and automotive markets, formed a partnership with Baidu to use AI for a cloud-to-car autonomous-car platform. Hyundai was the first global car manufacturer to deploy Baidu's AI assistant, Duer OS Auto, and jointly develop a connected-car solution.[50]

•••

China has become a force to be reckoned with in digital at home and around the world. As a major worldwide investor in digital technologies and one of the world's leading adopters of such technologies, it is already shaping the global digital landscape and supporting and inspiring entrepreneurship far beyond its own borders.

But there is much more to come. As China digitizes, industries will experience huge shifts in revenue and profit pools across the value chain. This creative destruction is happening globally as the world digitizes, but it is likely to happen more quickly and be on a relatively large scale in China given its combination of inefficiencies in traditional sectors and massive potential for commercialization. Players who emerge as winners are likely to be of sufficient scale to influence the global digital landscape and inspire digital entrepreneurs far beyond China's borders.

A forthcoming McKinsey Global Institute report in late 2017 will look closely at how digital disruption will enable companies to improve their efficiency, boost revenue, and optimize cost, and how three types of digital disruption—dematerialization, disintermediation, and disaggregation—can help to restructure value chains and increase the speed of the disruption.[51] The research will explore how policy makers can facilitate a healthy transition, and what choices companies can make to prepare for the impending wave of change.

[49] Lee Min-hyung, "KT, Kakao set to lead online bank with on-demand service," *The Korea Times*, November 30, 2015.

[50] Jhoo Dong-chan, "Hyundai joins hands with Baidu," *The Korea Times*, July 3, 2017.

[51] Dematerialization, or virtualization, means changing the formats of products or processes from physical to virtual, unbundling demand with digital delivery, and enabling consumers to receive products or services anywhere, at any time. Disintermediation shortens the distance between suppliers and customers by linking then directly through digital platforms. As the rapid growth of e-commerce indicates, disintermediation has been a major trend in China. Disaggregation describes the process of separating huge assets into many pieces, turning them into services, and catering to a fragmented consumer base, thereby unlocking unused supply.

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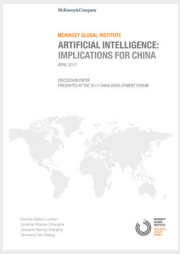

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